I CLAIM:

1. In a fuel cell stack comprising a plurality of substantially planar fuel cell units, each said fuel cell unit having an anode electrode, a cathode electrode, and an electrolyte disposed therebetween, and a separator plate disposed between said anode electrode of one said fuel cell unit and said cathode electrode of an adjacent said fuel cell unit, said separator plate comprising guide means for distributing fuel and oxidant to said anode electrode and said cathode electrode, respectively, the improvement comprising:

said separator plate constructed of at least two substantially coextensive sheet metal elements having a substantially flat peripheral region and a central region comprising a plurality of substantially uniform corrugations, said corrugations of a first of said sheet metal elements and a second of said sheet metal elements having substantially equal peak-to-peak distances and said corrugations of said first of said sheet metal elements having a peak-to-valley distance greater than said corrugations of said second of said sheet metal elements; and

said sheet metal elements aligned whereby each corrugation valley of each said corrugation of said first of said sheet metal elements contacts a corresponding corrugation valley of said second of said sheet metal elements, forming a coolant flow channel between each corrugation peak of said corrugations of said first of said sheet metal elements and a corresponding corrugation peak of said corrugations of said second of said sheet metal elements.

2. A fuel cell stack in accordance with Claim 1, wherein said fuel cell unit is a fuel cell type selected from the group consisting of molten carbonate, solid oxide, phosphoric acid and polymer electrolyte membrane.

3. A fuel cell stack in accordance with Claim 1, wherein said at least two sheet metal elements are constructed of a material selected from the group consisting of nickel, stainless steel, high alloy steel, titanium and metals coated to prevent corrosion.

4. A fuel cell stack in accordance with Claim 2, wherein said fuel cell unit is a polymer electrolyte membrane fuel cell.

5. A fuel cell stack in accordance with Claim 4, wherein said at least two sheet metal elements are constructed of a chromium-nickel austenitic alloy comprising on a combined basis at least about 50% by weight chromium and nickel.

6. A fuel cell stack in accordance with Claim 1 further comprising a plurality of internal manifolds for supplying said fuel and oxidant to each of said fuel cell units and for removal of exhaust gases therefrom and for providing coolant to said coolant flow channels.

7. A fuel cell stack in accordance with Claim 1, wherein said corrugation valleys have an arcuate profile.

8. In a fuel cell stack comprising a plurality of fuel cell units, each said fuel cell unit having an electrolyte-electrode-assembly with an anode electrode on one face and a cathode electrode on an opposite face, an anode current collector on said anode electrode side of said electrolyte-electrode-assembly and a cathode current collector on said cathode side of said electrolyte-electrode-assembly, and a separator plate disposed between said anode electrode side of said electrolyte-electrode-assembly of one said fuel cell unit and said cathode electrode side of said electrolyte-electrode-assembly of an adjacent said fuel cell unit having guide means for distributing fuel and oxidant gases to said anode electrode side and said cathode electrode side and forming an anode chamber between the anode electrode facing face of said separator plate and said anode electrode and forming a cathode chamber between the opposite cathode electrode facing face of said separator plate and the cathode electrode of an adjacent said fuel cell unit, said anode chamber in gas communication with a fuel gas supply and outlet and said cathode chamber in gas communication with an oxidant gas supply and outlet, the improvement comprising:

said separator plate constructed of at least two substantially coextensive sheet metal elements having a substantially flat peripheral region and a central region comprising a plurality of substantially uniform corrugations, said corrugations of a

first of said sheet metal elements and a second of said sheet metal elements having substantially equal peak-to-peak distances and said corrugations of said first of said sheet metal elements having a peak-to-valley distance greater than said corrugations of said second of said sheet metal elements;

said sheet metal elements aligned whereby each corrugation valley of each said corrugation of said first of said sheet metal elements contacts a corresponding corrugation valley of said second of said sheet metal elements, forming a coolant flow channel between each corrugation peak of said corrugations of said first of said sheet metal elements and a corresponding corrugation peak of said corrugations of said second of said sheet metal elements;

said separator plates having a flattened peripheral seal structure extending to contact one of said electrolyte-electrode-assemblies and said current collectors on each face of said separator plates completely around said anode chamber and said cathode chamber, respectively, forming a peripheral seal under cell operating conditions;

said electrolyte-electrode-assemblies and said separator plates each having a plurality of aligned perforations, said perforations in said separator plates being surrounded on said anode electrode facing face and said cathode electrode facing side by a flattened manifold seal structure extending to contact one of said electrolyte-electrode-assemblies and said current collectors on said anode electrode facing sides and said cathode electrode facing sides of said separator plates, forming

a manifold seal under cell operating conditions to form a plurality of fuel gas and oxidant gas manifolds extending through said cell stack;

fuel conduits through said flattened manifold seal structure providing fuel gas communication between said fuel gas manifolds and said anode chambers on said anode electrode facing side of said separator plates, thereby providing fully internal manifolding of fuel to and from each said fuel cell unit in said fuel cell stack; and

oxidant conduits through said flattened manifold seal structure providing oxidant gas communication between said oxidant gas manifolds and said cathode chambers on said cathode electrode facing side of said separator plates, thereby providing fully internal manifolding of oxidant to and from each said fuel cell unit in said fuel cell stack.

9. A fuel cell stack in accordance with Claim 8, wherein said separator plates and said electrolyte-electrode-assemblies form a plurality of aligned coolant fluid openings, said openings in said separator plates being surrounded on said anode electrode facing face and said cathode electrode facing side by a flattened coolant fluid manifold seal structure extending to contact one of said electrolyte-electrode-assemblies and said current collectors on said anode electrode facing sides and said cathode electrode facing sides of said separator plates, forming a coolant fluid manifold seal under cell operating conditions to form a plurality of coolant fluid

manifolds extending through said cell stack.

10. A fuel cell stack in accordance with Claim 8, wherein said fuel cell unit is a fuel cell type selected from the group consisting of molten carbonate, solid oxide, phosphoric acid and polymer electrolyte membrane.

11. A fuel cell stack in accordance with Claim 8, wherein said at least two sheet metal elements are constructed of a material selected from the group consisting of nickel, stainless steel, high alloy steel, titanium and metals coated to prevent corrosion.

12. A fuel cell stack in accordance with Claim 10, wherein said fuel cell unit is a polymer electrolyte membrane fuel cell.

13. A fuel cell stack in accordance with Claim 12, wherein said at least two sheet metal elements are constructed of a chromium-nickel austenitic alloy comprising on a combined basis at least about 50% by weight chromium and nickel.

14. A fuel cell stack in accordance with Claim 8, wherein said corrugation valleys have an arcuate profile.